

## CLAIMS

5  
1. A method of providing a silicon micro-needle, the micro-needle having a base adjoining a silicon substrate, a tip remote from said base, and a duct in at least a region of said tip, the method comprising:

- a. providing a duct in said silicon substrate; and subsequently
- b. selectively removing the substrate from around the duct to provide a micro-needle coincident with the duct.

10 2. A method according to claim 1 wherein the duct passes substantially between the tip and the base

15 3. A method according to claim 1 or 2 wherein a mask is lithographically provided on a substrate of the first material prior to the formation of the duct.

20 4. A method according to claim 3 wherein the mask is used to provide the duct which is fabricated by any one of the following techniques: plasma enhanced etching, laser ablation, light assisted anodisation, ion beam milling, focused ion beam milling.

25 5. A method according to any one of the preceding claims wherein the micro-needle is bounded by planes of the first material which have a low etch rate.

6. A method according to claim 5 wherein an anisotropic etch is used to selectively remove the first material.

- ca* 7. A method according to ~~any one of the preceding claims~~ wherein the first material is removed by any one of the following methods: focused ion beam milling, etching combined with a domed resist mask.
- Sub A1* 8. A method of providing a silicon micro-needle, the micro-needle having a base adjoining a silicon substrate, a tip remote from said base, and a duct in at least a region of said tip, the method comprising:
  - selectively removing the silicon substrate to provide a micro-needle; and subsequently
  - providing a duct coincident with the micro-needle.
- 10 9. A method according to claim 8 wherein the duct passes substantially between the tip and the base.
- ac* 15 10. A method according to claim 8 or 9 wherein the micro-needle is bounded by planes of the first material which have a low etch rate.
- 20 11. A method according to claim 10 wherein an anisotropic etch is used to selectively remove the first material.
- ca* 12. A method according to claims 8 or 9 wherein said micro-needle is formed by any one of the following techniques: focused ion beam milling, etching combined with a domed resist mask.
- ca* 25 13. A method according to any one of claims 8 to 12 wherein once the micro-needle has been formed a planar surface is provided covering the micro-needle.
- 30 14. A method according to claim 13 wherein the duct is provided by lithographic processes performed on the planar surface.

*SUB A1*

15. A method according to claim 14 wherein once the duct has been provided the planar surface is removed.

*aa*

5 16. A method according to any one of the preceding claims wherein the method is arranged to provide a micro-needle whose outer walls are inclined to a plane that is perpendicular to the substrate to which the micro-needles are adjacent.

10 17. A method of providing a micro-needle on the surface of a first material, the micro-needle having a base adjoining the first material, a tip remote from said base, and a duct in at least a region of said tip, the method comprising:

- a. providing a duct in said first material,
- 15 b. lining said duct with a second material, and
- c. removing said first material from around said second material leaving a micro-needle fabricated from said second material attached to said first material and upstanding therefrom.

20 18. A method according to claim 17 wherein the duct passes substantially between the tip and the base.

*SUB A1*

19. A method according to claim 17 or 18 wherein the second material is any one of the following materials: SiO<sub>2</sub>, a metal, ceramic, a polymer, 25 a semi-conductor.

*aa*

20. A method according to any one of claims 17 to 19 wherein a portion of the second material covering the inside surface of the duct is removed before or whilst the first material is removed from around the second 30 material.

- an Sub A* 21. A method according to any one of claims 17 to 20 wherein the first material is removed by etching.
- aa* 5 22. A method according to any one of claims 17 to 21 wherein a mask is lithographically provided on a substrate of the first material prior to the formation of the duct.
- 10 23. A method according to claim 22 wherein the mask is subsequently used to control fabrication of the duct.
- aa* 15 24. A method according to any one of claims 17 to 23 wherein the duct is fabricated using any one of the following processes: plasma based etching, laser ablation, focused ion beam milling, light assisted anodisation of silicon.
- aa* 20 25. A method according to any one of claims 17 to 24 wherein the second material is provided by any one of the following processes: oxidiation, deposition.
- aa* 26. A method according to any one of claims 17 to 25 wherein the micro-needle is shaped by removing a portion of the second material.
- aa* 25 27. A method according to any preceding claim in which once the micro-needle has been created the method further includes linking the duct to a reservoir.
- 30 28. A method according to claim 27 in which a portion of the first material is removed from a side opposite a side of the first material where the micro-needle has been fabricated.

TO 2020 PCT PRACTICE

*an Sub A1 29* A method according to claims 27 or 28 in which the first material is attached to a second piece of material.

5 30. A method according to claim 29 in which the second piece of material has a channel which connects to the duct and links the duct to a reservoir.

*an* 31. A method according to claim 29 or claim 30 in which the first material has a channel which connects to the duct and links the duct to a reservoir.

*an* 32. A method according to any one of claims 29 to 31 in which the two pieces of material are fabricated from same material.

15

*an* 33. A method according to any preceding claim in which the micro-projection is fabricated substantially normal to the surface of the first material.

*an* 20 34. A method according to any one of the preceding claims wherein a surface region of the micro-needle is porosified after the needle has been fabricated.

*an* 25 35. A method according to claim 25 wherein the porosification is provided by one of the following techniques: electrochemical anodisation, or immersing the structure in a stain etching solution.

*work on the last  
claim*

*an* 36. A micro-needle fabricated according to the methods of any one of claims 1 to 35.